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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/560,139

12/09/2005

Avto Tavkhelidze

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Borealis Technical Limited
23545 N W Skyline Blvd
North Plains, OR 97133-9205

EXAMINER

RAO, SHRINIVAS H

ART UNIT	PAPER NUMBER
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2814

MAIL DATE	DELIVERY MODE
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07/08/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/560,139	TAVKHELIDZE ET AL.	
	Examiner	Art Unit	
	STEVEN H. RAO	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 December 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12/11/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Priority

This application is the U.S. national stage application of International Application PCT/US2004/018688, filed June 9, 2004, which international application was published on December 23, 2004, as International Publication WO2004/111552 in the English language. The International Application claims the benefit of U.K. Application No. 0313317.0, filed June 10, 2003.

Therefore Claims 1-14 as recited in the filling of 12/09/2005 are currently pending in the Application.

Information Disclosure Statement

The IDS filed on 12/01/2009 has been considered and the initialed PTO-1449 made of record in the E-red folder.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-4 and 5- 10 are rejected under 35 U.S.C. 103(a) as being obvious over Ogasawara et al. (U.S. patent No. 5,894,189 herein after Ogasawa) and/or (U.S. Patent No. 5,594,263 herein after Bedard) in view of AAPR (applicants admitted prior art – figs.1-2 and specification pages 1-3 line25, etc. herein after AAPR).

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With respect to claim I Ogasawara / Bedard describes a tunnel diode comprising:

(a) an emitter electrode, (fig.3 # 15, col. 6 lines 7-8, Bedard abstract 3rd last line diode/emitter) in contact (taken to be electrical contact) fig.3 15 in contact with 14) with (b) a porous material, (fig.3 # 14, col. 6 line 11 Bedard abstract lines -4,5) in contact (taken to be electrical contact) with

(c) a collector electrode (fig. 3 # 2, col.2 line 39) (2 in electrical contact with 15-e.g fig.4, Bedard abstract-diode w/collector) .

Ogasawara and Bedard do not specifically mention wherein said porous material has a thickness which is less than the free mean free path of an electron in said porous material.

However , AAPR describes in page 2 lines 13-27 and figure 2 etc. wherein said island I has a thickness which is less than the free mean free path of an electron in said island material, so that electrons can travel through such a system without interaction with lattice of intervening materials it has to travel through.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include AAPR's island thickness having a thickness which is less than the free mean free path of an electron in said island material in Ogasawara's device instead of Ogasawara's porous material , the motivation for the above combination is to facilitate the electrons to travel through such a system without interaction with lattice of intervening materials it has to travel through.

It is further noted that the high end of the thickness namely 100nms (see claim 4 below) claim is met /described by the Ogasawara reference in col. 6 line 42 and Bedard and optimum thickness of the porous layer is merely a discovery of an optimum range.

Ogasawara discloses the claimed invention including a thickness of 100 nm, except for the thickness range of 1 to 100 nms (i.e. which is less than the free mean free path of

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an electron in said porous material) . It would have been obvious to one having ordinary skill in the art at the time of the invention was made to include the porous layer thickness in the range of 1 to 100nms (i.e. which is less then the free mean free path of an electron in said porous material), since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable range involves only routine skill in the art. In re Aller, 105 USPQ 233, see also In re Boesch, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980).

Also , it is noted that the specification contains no disclosure of either the critical nature of the claimed thickness range 1-100nms or any unexpected results arising therefrom. where patentability is said to be based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the choosen dimension are critical. In re Woodruff, 919 F. 2d. 1575,1578, 16 USPq 2d 1934, 1936 (Fed.Cir. 1990).

With respect to claims 2 and 3 Ogasawara and Bedard describes the tunnel diode of claim 1 in which said porous material comprises porous silicon, doped porous silicon. (col. 3 line 46-p-type porous Si layer, Bedard abstract)

With respect to claims 4 and 10 Ogasawara and Bedard describes the tunnel diode of claim 1 in which said thickness is in the range of 1 to 100 nm. (Ogasawara col. 6 lines 29 to 46 and for reasons under claim1 above, Bedrad whole patent)

With respect to claim 5 Ogasawara and Bedard describes the tunnel diode of claim 1 additionally comprising a heat source in contact (i.e. thermally contacted-applicants' specification page 4 etc.) with said emitter electrode. (AAPR –page 1 , line 12 etc. i.e 3,169,200 –col.1 lines 60-65).

With respect to claim 7 and Bedard Ogasawara describes an apparatus for the conversion of energy comprising:

(a) a source of energy; (Ogasawara fig.5 Vps,Vc, col.5 lines 49-52bedard – col.4) (b) an emitter electrode connected to said source of energy; (Ogasawara fig.5 #15 connected to Vc, Bedard)

(c) a collector electrode; (Ogasawara fig. 5 #2, Bedard-see claim 1) (d) a porous material disposed between said emitter electrode and said collector electrode; (AAPR figure 2, page 3 lines 10-21,etc.) (e) an electrical circuit connecting said electrodes (Ogasawra col. 5 lines 49-56, Bedard) ;

Ogasawra and Bedard does not specifically describe wherein said porous material has a thickness which is less then the free mean free path of an electron in said porous material.

However , AAPR describes in page 2 lines 13-27 and figure 2 etc. wherein said island material has a thickness which is less then the free mean free path of an electron in

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said island material, so that electrons can travel through such a system without interaction with lattice of intervening materials it has to travel through.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include AAPR's island material has a thickness which is less than the free mean free path of an electron in said island material in Ogasawara's device, the motivation for the above combination is to facilitate the electrons to travel through such a system without interaction with lattice of intervening materials it has to travel through.

It is further noted that the high end of the thickness namely 100nm (see claim 4 below) of the claim is met/described by the Ogasawara reference in col. 6 line 42 and optimum thickness of the porous layer is merely a discovery of an optimum range. Ogasawara discloses the claimed invention including a thickness of 100 nm, except for the thickness range of 1 to 100 nm (i.e. which is less than the free mean free path of an electron in said porous material). It would have been obvious to one having ordinary skill in the art at the time of the invention was made to include the porous layer thickness in the range of 1 to 100nm (i.e. which is less than the free mean free path of an electron in said porous material), since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable range involves only routine skill in the art. In re Aller, 105 USPQ 233, see also In re Boesch, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980).

Also, it is noted that the specification contains no disclosure of either the critical nature of the claimed thickness range 1-100nm or any unexpected results arising therefrom.

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where patentability is said to be based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. In re Woodruff, 919 F. 2d. 1575,1578, 16 USPq 2d 1934, 1936 (Fed. Cir. 1990)

With respect to claims 8 and 9 Ogasawara describes the apparatus of claim 7 in which said porous material comprises porous silicon, doped porous silicon. (Ogasawara col. 3 line 46-p-type porous Si layer, Bedard abstract).

B. Claims 6 and 11-14 are rejected under 35 U.S.C. 103(a) as being obvious over Ogasawara et al. (U.S. patent No. 5,894,189 herein after Ogasawa) and/or (U.S. Patent No. 5,594,263 herein after Bedard) in view of AAPR (applicants admitted prior art – figs.1-2 and specification pages 1-3 line25, etc. herein after AAPR) as applied to Claims 1-5 and 7-9 above and further in view of Takagi (U.S. Patent No. 5,636,234, herein after Takagi).

With respect to claim 6 Ogasawara and Bedard describes the tunnel diode of claim 1 . Ogasawara and AAPR do not specifically describe a heat sink in contact with said collector electrode.

However, Takagi, a patent from the same field of invention describes in figures 12, etc. a heat sink in contact with said collector electrode, to remove the heat generated while operating the device and thereby ensure continued device performance at peak

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efficiency and integrating the semiconductor chip and heat sink structure to eliminate the necessity of bonding reducing manufacturing costs and simplifying assembly process (Takagi col. 7 lines 21-25).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include Takagi's heat sink structure in Ogasawara and AAPR's device , the motivation for the combination is to remove the heat generated while operating the device and thereby ensure continued device performance at peak efficiency and integrating the semiconductor chip and heat sink structure to eliminate the necessity of bonding reducing manufacturing costs and simplifying assembly process (Takagi col. 7 lines 21-25).

With respect to claim 11 Ogasawara and Bedard describes the apparatus of claim 7, wherein the conversion of energy is the conversion of thermal energy to electrical energy, wherein said source of energy comprises a source of thermal energy, and wherein said apparatus further comprises:

- a) a first thermal interface thermally connecting said source of energy to said emitter electrode; (AAPR page 1 lines 15 to 23) .
- b) a second thermal interface thermally connecting a heat sink means to said collector electrode; (Takagi fig. 12 2 connected to 4)
- c) an electrical load, electrically connected by said circuit between said collector electrode and said emitter electrode. (Ogasawara e.g fig.5)

With respect to claim 12 Ogasawara and Bedard describes the apparatus of claim 11i

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wherein said source of thermal energy is of solar origin. (well known in the art and Official notice is taken that solar energy is a source of thermal energy).

With respect to claim 13 and Bedard Ogasawara describes the apparatus of claim 7, wherein the conversion of energy is the conversion of electrical energy to heat pumping capacity, and wherein said apparatus further comprises:

- a) a heat source and a heat sink, wherein said heat source is thermally connected to said emitter electrode and said heat sink is thermally connected to said collector electrode, (rejected for reasons under claim 12 above) and,
- b) an electrical power supply, electrically connected by said circuit between said collector electrode and said emitter electrode for applying a voltage bias to said electrodes, said electrical power supply providing said energy source. (Ogasawara figure 5, etc.).

With respect to claim 14 Ogasawara and Bedard describes the apparatus of claim 13 wherein said heat source may be cooler than said heat sink. (AAPR page 1 lines 15-17).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEVEN H. RAO whose telephone number is (571)272-1718. The examiner can normally be reached on 8.30-5.30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1714. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Steven H Rao/

Examiner, Art Unit 2814